

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) An image reading apparatus for processing, for each reading line, image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting, for each object reading line, ~~a pixel~~ pixels with the quantity of change in density higher than a threshold value as ~~a probable edge point~~ probable edge points thought to be ~~[[a]] document edge points point~~ and an edge point of a projecting area where a light source outside the image reading apparatus is projected, and

contour correction means for determining whether ~~[[the]]~~ each probable edge point is a ~~document edge point indicating the position of a document edge~~ the edge point of the projecting area or not, on the basis of the position of said probable edge ~~points point~~ points, said contour correction means recognizing the probable edge ~~points except the edge point of the projecting area as the document edge points point as the document edge point~~ except the edge point of the projecting area as the document edge points ~~upon determining the probable edge point to be the document edge point.~~

2. (Previously Presented) The image reading apparatus of claim 1 wherein said contour detecting means is provided with density change calculating means for working out the quantity of change in density on the basis of the image density of pixels around an object pixel.

3. (Currently Amended) The image reading apparatus of claim 2 wherein said contour detecting means is provided with judgement means for detecting the object pixel as

[[said]] a probable edge point if the values of the respective pixels are identical when the densities of a specific number of consecutive pixels either in the direction of scanning or opposite direction of scanning are binarized on a specific slice level.

4. (Currently Amended) [[The]] An image reading apparatus of claim 3 for processing, for each reading line, image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting, for each object reading line, a pixel with the quantity of change in density higher than a threshold value as a probable edge point thought to be a document edge point, and

contour correction means for determining whether the probable edge point is a document edge point indicating the position of a document edge on the basis of the position of said probable edge point, said contour correction means recognizing the probable edge point as the document edge point, upon determining the probable edge point to be the document edge point, wherein

said contour detecting means is provided with density change calculating means for working out the quantity of change in density on the basis of the image density of pixels around an object pixel, and

said contour detecting means is further provided with judgement means for detecting the object pixel as said probable edge point if the values of the respective pixels are identical when the densities of a specific number of consecutive pixels either in the direction of scanning or opposite direction of scanning are binarized on a specific slice level, wherein

when each reading line is scanned in a specific direction and the density values of a specific number of consecutive pixels in the opposite direction of scanning from said probable edge point are binarized on a specific slice level, said judgement means recognizes said probable edge point to which the values of the respective pixels are identical and judges as a first probable edge point the probable edge point first recognized out of recognized probable edge points, and

~~wherein~~ when each reading line is scanned in a specific direction and the density values of a specific number of consecutive pixels in the direction of scanning from said probable edge point are binarized on a specific slice level, said judgement means recognizes said probable edge point to which the values for the respective pixels are identical and judges as a second probable edge point the probable edge point first recognized out of recognized probable edge points.

5. (Currently Amended) ~~[[The]]~~ An image reading apparatus of claim 3 for processing, for each reading line, image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting, for each object reading line, a pixel with the quantity of change in density higher than a threshold value as a probable edge point thought to be a document edge point, and

contour correction means for determining whether the probable edge point is a document edge point indicating the position of a document edge on the basis of the position of said probable edge point, said contour correction means recognizing the probable edge point as the document edge point, upon determining the probable edge point to be the document edge point, wherein

said contour detecting means is provided with density change calculating means for working out the quantity of change in density on the basis of the image density of pixels around an object pixel, and

said contour detecting means is further provided with judgement means for detecting the object pixel as said probable edge point if the values of the respective pixels are identical when the densities of a specific number of consecutive pixels either in the direction of scanning or opposite direction of scanning are binarized on a specific slice level, wherein

when the densities of a specific number of consecutive pixels either in the scanning direction or the opposite direction of scanning from the object pixel are binarized on a specific slice level in an object image of which the density change quantity is regarded by said density change calculating means as less than said threshold value and not lower than a second threshold value which is less than said threshold value and in case the values of the respective pixels after binarization are identical, said judgement means detects said pixels as tentative probable edge points.

6. (Previously Presented) The image reading apparatus of claim 5 wherein, when each reading line is scanned in a specific direction and the density values of a specific number of consecutive pixels in the opposite direction of scanning from each tentative probable edge point are binarized on a specific slice level, said judgement means perceives said tentative probable edge point to which the values of the respective pixels after binarization are identical and judges as a first tentative probable edge point the tentative probable edge point first recognized out of said recognized tentative probable edge points, and

when each reading line is scanned in a specific direction and the density values of a specific number of consecutive pixels in the direction of scanning from each tentative probable edge point are binarized on a specific slice level, said judgement means perceives said tentative probable edge point to which the values of the respective pixels after binarization are identical and judges as a second tentative probable edge point the probable edge point last perceived out of said tentative perceived probable edge points, and at the same time,

when said second tentative probable edge point is not detected on the reading line to which said first tentative probable edge point belongs, said judgement means regards said first tentative probable edge point as a first probable edge point, and

when said first tentative probable edge point is not detected on the reading line to which said second tentative probable edge point belongs, said judgement means regards said second tentative probable edge point as a second probable edge point.

7. (Currently Amended) The image reading apparatus of claim 1 wherein said contour correction means determines as permissible scope a scope of a specific distance on an object reading line on the basis of a straight line passing through two probable edge points detected on separate reading lines between which a specific number of reading lines are intervened, and recognizes a probable edge point on the object reading line in said permissible scope as [[said]] a document edge point.

8. (Currently Amended) The image reading apparatus of claim 1 wherein said contour correction means determines as permissible scope a scope of a specific distance on an object reading line on the basis of a probable edge point detected on a reading line separated

from the object reading line by a specific number of reading lines, and recognizes said probable edge point as [[said]] a document edge point when said probable edge point on the object reading line is present in said permissible scope.

9. (Currently Amended) [[The]] An image reading apparatus of claim 1 for processing, for each reading line, image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting, for each object reading line, a pixel with the quantity of change in density higher than a threshold value as a probable edge point thought to be a document edge point, and

contour correction means for determining whether the probable edge point is a document edge point indicating the position of a document edge on the basis of the position of said probable edge point, said contour correction means recognizing the probable edge point as the document edge point, upon determining the probable edge point to be the document edge point,
wherein

said contour correction means works out the gradients of a first permissible scope-setting straight line passing through an object probable edge point out of permissible scope-setting straight lines passing through two probable edge points separated from each other by a specific number of reading lines, a second permissible scope-setting straight line passing through said probable edge point detected on a second reading line separated from the reading line to which said object probable edge point belongs, by one or a plurality of reading lines, and a third permissible scope-setting straight line passing through said probable edge point detected on a

third reading line separated from the reading line to which said object probable edge point belongs, by one or a plurality of reading lines,

determines a permissible scope on the basis of a gradient difference value between the second permissible scope-setting straight line and the first permissible scope-setting straight line and a gradient difference value between the third permissible scope-setting straight line and the second permissible scope-setting straight line, and

in case the object probable edge point is present in the permissible scope, recognizes said object probable edge point as said document edge point.

10. (Currently Amended) The image reading apparatus of claim 1 wherein in a reading line where ~~[[said]]~~ any document edge point is not recognized, said contour correction means recognizes a specific pixel belonging to said reading line as ~~[[said]]~~ a document edge point on the basis of document edge points recognized on other reading lines.

11. (Currently Amended) ~~[[The]]~~ An image reading apparatus ~~of claim 10~~ for processing, for each reading line, image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting, for each object reading line, a pixel with the quantity of change in density higher than a threshold value as a probable edge point thought to be a document edge point, and

contour correction means for determining whether the probable edge point is a document edge point indicating the position of a document edge on the basis of the position of said probable edge point, said contour correction means recognizing the probable edge point as the

document edge point, upon determining the probable edge point to be the document edge point,
wherein

in a reading line where said document edge point is not recognized, said contour
correction means recognizes a specific pixel belonging to said reading line as said document
edge point on the basis of document edge points recognized on other reading lines, wherein

said contour correction means recognizes as said document edge point a pixel located at the intersection point of a straight line passing through a document edge point recognized on one or a plurality of reading lines except for an object reading line and the object reading line.

12. (Currently Amended) The image reading apparatus of claim 1 wherein said contour correction means acquires positional information on said probable edge points ~~point~~ by scanning image data in one or a plurality of directions, said image data outputted from said image sensor, and recognizes said document edge points ~~point~~ on the basis of positional information acquired by scanning in one direction or in different directions.

13. (Currently Amended) The image reading apparatus of claim 12 wherein when ~~[[said]]~~ any probable edge point is not detected on a specific number of consecutive reading lines counted from the object reading line in a specific direction where ~~[[said]]~~ a probable edge point is detected, said contour correction means scans the image data in an opposite direction, said image data outputted from said image sensor.

14. (Currently Amended) ~~[[The]]~~ An image reading apparatus of claim 13 for processing, for each reading line, image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting, for each object reading line, a pixel with the quantity of change in density higher than a threshold value as a probable edge point thought to be a document edge point, and

contour correction means for determining whether the probable edge point is a document edge point indicating the position of a document edge on the basis of the position of said probable edge point, said contour correction means recognizing the probable edge point as the document edge point, upon determining the probable edge point to be the document edge point, wherein

said contour correction means acquires positional information on said probable edge point by scanning image data in one or a plurality of directions, said image data outputted from said image sensor, and recognizes said document edge point on the basis of positional information acquired by scanning in one direction or in different directions, and

when said probable edge point is not detected on a specific number of consecutive reading lines counted from the object reading line in a specific direction where said probable edge point is detected, said contour correction means scans the image data in an opposite direction, said image data outputted from said image sensor, and

said contour correction means recognizes as said document edge point a pixel located at the intersection point between the object reading line and a straight line passing through one or a plurality of said document edge points recognized by scanning in a specific direction or a straight

line passing through one or a plurality of said document edge points recognized by scanning in the other direction.

15. (Currently Amended) The image reading apparatus of claim 1 which comprises thinning out means for recognizing a representative value on the basis of positional information on said probable edge points ~~point~~ detected on one or a plurality of reading lines and

contour correction means for recognizing the document edge points ~~point~~ on the basis of said representative value.

16. (Previously Presented) The image reading apparatus of claim 15 wherein said representative value is a middle point between two probable edge points.

17. (Currently Amended) The image reading apparatus of claim 1, further comprising:

signal generating means for generating effective width signals indicating a document contour on the basis of said document edge points ~~point~~ and

image forming means for generating an image within the document contour on the basis of image data outputted from said image sensor and said effective width signals.

18. (Currently Amended) The image reading apparatus of claim 1, further comprising output substitution means for detecting the outside of a document contour of the image data outputted from said image sensor on the basis of said document edge points ~~point~~, substituting the image data outside said document contour with a white image and outputting the data.

19. (Currently Amended) The image reading apparatus of claim 1, further comprising image data substituting means for detecting the outside of a document contour of the image data on the basis of said document edge ~~points~~ point, said image data stored in an image memory for storing said image data outputted from said image sensor, and substituting the image data outside said document contour with a white image.

20. (Previously Presented) The image reading apparatus of claim 1, further comprising document image reading means for detecting a document contour of the image data on the basis of said document edge points, said image data stored in an image memory, and outputting the image data within said detected document image contour only.

21. (Previously Presented) The image reading apparatus of claim 1, further comprising closing and opening detection means for detecting a document cover to prevent light from reaching said image sensor from outside and the opening and closing of said document cover and, in case the document cover is opened, actuates said contour detecting means.

22. (Currently Amended) A processing apparatus for processing image data, comprising:

contour detecting means for detecting ~~a pixel as a probable edge point~~ pixels as probable edge points thought to be ~~[[a]] document edge points~~ point and an edge point of a projecting area where a light source outside the processing apparatus is projected, said ~~pixel~~ pixels having a higher quantity of change in density than a threshold value, and

contour correction means for determining whether ~~[[the]]~~ each probable edge point is a ~~document edge point indicating the position of a document edge~~ the edge point of the projecting area or not, on the basis of the position of said probable edge ~~points~~ point, said contour correction means recognizing the probable edge ~~points except the edge point of the projecting area as the document edge points~~ point as the document edge point, ~~upon determining the probable edge point to be the document edge point.~~

23. (Previously Presented) An image reading apparatus for processing image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting a pixel with the quantity of change in density higher than a threshold value as a probable edge point thought to be a document edge point, and

contour correction means for recognizing the document edge point indicating the position of a document edge on the basis of the position of said probable edge point, wherein

said contour detecting means is provided with judgement means for detecting an object pixel as said probable edge point if the values of the respective pixels are identical when the densities of a specific number of consecutive pixels either in the direction of scanning or opposite direction of scanning are binarized on a specific slice level,

when each reading line is scanned in a specific direction and the density values of a specific number of consecutive pixels in the opposite direction of scanning from said probable edge point are binarized on a specific slice level, said judgement means recognizes said probable edge point to which the values of the respective pixels are identical and judges as a first probable edge point the probable edge point first recognized out of recognized probable edge points, and

wherein when each reading line is scanned in a specific direction and the density values of a specific number of consecutive pixels in the direction of scanning from said probable edge point are binarized on a specific slice level, said judgement means recognizes said probable edge point to which the values for the respective pixels are identical and judges as a second probable edge point the probable edge point first recognized out of recognized probable edge points.

24. (Previously Presented) An image reading apparatus for processing image data outputted from an image sensor, said apparatus comprising:

contour detecting means for detecting a pixel with the quantity of change in density higher than a threshold value as a probable edge point thought to be a document edge point, and

contour correction means for recognizing the document edge point indicating the position of a document edge on the basis of the position of said probable edge point, wherein

said contour detecting means is provided with judgement means for detecting an object pixel as said probable edge point if the values of the respective pixels are identical when the densities of a specific number of consecutive pixels either in the direction of scanning or opposite direction of scanning are binarized on a specific slice level, and

when the densities of a specific number of consecutive pixels either in the scanning direction or the opposite direction of scanning from the object pixel are binarized on a specific slice level in an object image of which the density change quantity is regarded by said density change calculating means as less than said threshold value and not lower than a second threshold value which is less than said threshold value and in case the values of the respective pixels after binarization are identical, said judgement means detects said pixels as tentative probable edge points.